

THE INVENTION CLAIMED IS:

1. A system for reflow-soldering a part:

replacing air around an unsoldered part with a first inert gas;

removing the first inert gas to form a vacuum around the unsoldered part;

vacuum reflow soldering the unsoldered part to form a reflow-soldered part;

providing a second inert gas to fill the vacuum around the reflow-soldered part; and

replacing the second inert gas with air around the reflow-soldered part.

2. The system as claimed in claim 1 wherein:

the first and second inert gases are the same gas.

3. The system as claimed in claim 1 wherein:

vacuum reflow soldering comprises heating the around the integrated circuit package on the printed circuit board having solder paste printed thereon at a plurality of different temperatures in the vacuum.

4. The system as claimed in claim 1 wherein:

removing the first inert gas includes simultaneously heating the integrated circuit package on the printed circuit board having solder paste printed thereon at a plurality of different temperatures; and

replacing the second inert gas includes simultaneously cooling the integrated circuit package on the printed circuit board having solder thereon at a plurality of different temperatures.

5. The system as claimed in claim 1 comprising:

moving the the integrated circuit package on the printed circuit board in at least one direction of horizontally, vertically, and a combination thereof from replacing the air, removing the first inert gas, reflow soldering, providing the second inert gas, through replacing the second inert gas.

6. A system for reflow soldering an integrated circuit package on a printed circuit board comprising:

replacing air with a first inert gas around the integrated circuit package on the printed circuit board;

removing the first inert gas to form a vacuum around the integrated circuit package on the printed circuit board;

moving in a first move the integrated circuit package on the printed circuit board;

vacuum reflow soldering the integrated circuit package on the printed circuit board;
moving in a second move the integrated circuit package on the printed circuit board;
providing a second inert gas to fill the vacuum around the integrated circuit package
on the printed circuit board;

5 replacing the second inert gas with air around the integrated circuit package on the
printed circuit board;

moving in a third move the integrated circuit package on the printed circuit board; and
filling the vacuum with air, the first inert gas, or the second inert gas in respective
first, second, or third moves after moving the integrated circuit package on the
10 printed circuit board.

7. The system as claimed in claim 6 wherein:

vacuum reflow soldering provides the integrated circuit package on the printed circuit
board having solder bumps with 90% of the solder bumps formed having less
than 10% empty voids and 10% of the solder bumps having less than 20%
15 empty voids as a percentage of volume.

8. The system as claimed in claim 6 wherein:

vacuum reflow soldering comprises heating the around the integrated circuit package
on the printed circuit board having solder paste printed thereon at a plurality of
different temperatures in the vacuum.

20 9. The system as claimed in claim 6 wherein:

removing the first inert gas includes simultaneously heating the integrated circuit
package on the printed circuit board having solder paste printed thereon at a
plurality of different temperatures; and

replacing the second inert gas includes simultaneously cooling the integrated circuit
25 package on the printed circuit board having solder thereon at a plurality of
different temperatures in the unloading unit after moving the integrated circuit
package on the printed circuit board in the first move.

10. The system as claimed in claim 6 comprising:

moving the integrated circuit package on the printed circuit board in at least one
30 direction of horizontal, vertical, and a combination thereof.

11. A system for reflow soldering a part comprising:
a loading lock for replacing air around an unsoldered part with a first inert gas and for
removing the first inert gas to form a vacuum around the unsoldered part;
a reflow unit connected to the loading lock for vacuum reflow soldering the
unsoldered part to form a reflow-soldered part; and
an unloading lock connected to the reflow unit for providing a second inert gas for
filling the vacuum around the reflow-soldered part and replacing the second
inert gas around the reflow-soldered part with air.

12. The system as claimed in claim 11 wherein:
the loading and unloading locks have supplies of the first and second inert gases that
are the same gas.

13. The system as claimed in claim 11 wherein:
the reflow unit comprises a heating unit for heating at a plurality of different
temperatures the unsoldered part in the vacuum.

14. The system as claimed in claim 11 wherein:
the loading lock includes a pump for removing the first inert gas and a heating unit for
simultaneously heating at a plurality of different temperatures the unsoldered
part; and
the unloading lock includes a supply of inert gas for replacing the second inert gas
and a heating unit for simultaneously cooling at a plurality of different
temperatures the reflow-soldered part.

15. The system as claimed in claim 11 wherein:
a conveyor system for moving the part among the loading lock, the reflow unit, and
the unloading lock.

16. A system for reflow soldering an integrated circuit package on a printed circuit
board comprising:
a loading lock for replacing air with a first inert gas and for removing the first inert
gas to form a vacuum around the integrated circuit package on the printed
circuit board, the loading lock for filling the vacuum with air, the first inert
gas, or a second inert gas after removing the integrated circuit package on the
printed circuit board;

a reflow unit for vacuum reflow soldering the integrated circuit package on the printed circuit board;

an unloading lock for providing the second inert gas to fill the vacuum and for replacing the second inert gas with air around the integrated circuit package on the printed circuit board, the unloading lock for filling the vacuum with air, the first inert gas, or the second inert gas after removing the integrated circuit package on the printed circuit board; and

a conveyor system for moving the the integrated circuit package on the printed circuit board among and in the loading lock, the reflow unit, and the unloading lock.

17. The system as claimed in claim 16 wherein:

the reflow unit provides the integrated circuit package on the printed circuit board having solder bumps with 90% of the solder bumps formed having less than 10% empty voids and 10% of the solder bumps having less than 20% empty voids as a percentage of volume.

18. The system as claimed in claim 16 wherein:

the reflow unit comprises a heating unit for heating the integrated circuit package on the printed circuit board having solder paste printed thereon at a plurality of different temperatures in the vacuum after moving the integrated circuit package on the printed circuit board from the loading lock.

19. The system as claimed in claim 16 additionally comprising:

a loading unit for providing an unsoldered integrated circuit package and an unsoldered printed circuit board to the loading lock;

the loading lock [for heating at a plurality of different temperatures the integrated circuit package on the printed circuit board having solder paste printed thereon after moving the unsoldered integrated circuit package on the unsoldered printed circuit board from the loading unit;

the unloading lock for cooling at a plurality of different temperatures the soldered integrated circuit package on the soldered printed circuit board in the unloading lock after moving the integrated circuit package on the printed circuit board from the loading lock; and

an unloading unit for receiving a soldered integrated circuit package and soldered integrated circuit board from the unloading lock.

20. The system as claimed in claim 16 comprising:
a conveyor system for moving in horizontal, vertical, and a combination thereof the
integrated circuit package on the printed circuit board.